Case Reports

Ultrafast Computed Tomography in the Diagnosis and Evaluation of Anomalous Origin of the Right Coronary Artery

Bunji KAKU, M.D., Masami SIMIZU, M.D., Kouji KAJINAMI, M.D., Hiroyuki YOSHIO, M.D., Hidekazu INO, M.D., and Hiroshi MABUCHI, M.D.,

SUMMARY

Anomalous origin of the right coronary artery may lead to myocardial ischemia despite the absence of atherosclerosis. We report the case of a 52-year-old man who was admitted to our hospital with exertional chest discomfort and palpitations. An anomalous origin of the right coronary artery was demonstrated by coronary angiography. There was no evidence of atherosclerosis in either the left or right coronary arteries. However, detailed information regarding the proximal portion of the anomalous artery was not acquired by coronary angiography. In this patient, ultrafast computed tomography (UFT) revealed an acute angle takeoff of the anomalous right coronary artery from the aorta. Furthermore, the proximal portion of the right coronary artery traversed the aorta and pulmonary trunk. This case illustrates that UFT is useful for detecting an anomalous origin of the coronary arteries and evaluating the mechanism of myocardial ischemia in patients with anomalous origin of the coronary arteries. (Jpn Heart J 36: 807-811, 1995)

Key words: Ultrafast computed tomography (UFT) . Anomalous origin of the right coronary artery

The prolonged scanning period associated with acquisition remains a significant limitation in conventional computed tomography. Because most involuntary organ movement, particularly cardiac motion, occurs in periods shorter than 1 sec, motion blurring and motion-induced artifacts occur when the heart is imaged. Ultrafast computed tomography (UFT) using a scanning electron beam was developed for practical purposes by Boyd et al and the scanning period was significantly shortened to 100 msec. As a result, clear cardiac images can now be obtained by UFT.

From The Second Department of Internal Medicine, School of Medicine, Kanazawa University, Kanazawa, Japan.

Address for correspondence: Bunji Kaku, M.D., The Second Department of Internal Medicine, School of Medicine, Kanazawa University, Takara-machi 13-1, Kanazawa 920, Japan.

Received for publication June 5, 1995.
Accepted July 24, 1995.
An anomalous origin of the coronary artery can lead to angina pectoris, acute myocardial infarction and sudden death despite the absence of significant atherosclerotic coronary artery disease.\textsuperscript{2-6} The incidence of all coronary anomalies ranges from 0.3\% to 1.2\% and anomalous origin of the right coronary artery is reported to constitute from 6\% to 27\% of all coronary anomalies.\textsuperscript{2,5} Although anomalous origin of the right coronary artery has been considered benign,\textsuperscript{6} recent reports have revealed its clinical significance and potentially serious complications. Surgical revision has even been proposed.\textsuperscript{2-4} We present a case in which UFT was useful for detecting an anomalous origin of the right coronary artery and in evaluating the mechanism of myocardial ischemia.

**CASE REPORT**

A 52-year-old Japanese man with a history of diabetes mellitus was admitted to our hospital with chest discomfort and palpitations during exercise. As an adolescent, the patient experienced several episodes of chest discomfort, cold diaphoresis and presyncope while running a marathon and mountain climbing. Physical examination on admission was notable for premature cardiac contractions and an electrocardiogram demonstrated frequent premature ventricular contractions. A treadmill exercise test using a standard Bruce method was performed. During exercise, the patient complained of chest discomfort and presyncope. Exercise-induced hypotension was also observed. Prior to treadmill exercise, the patient’s blood pressure was 135/71 mmHg. Although his heart rate increased during exercise, his blood pressure dropped to 97/50 mmHg seven minutes into exercise. Furthermore, following exercise, his blood pressure dropped further to 67/45 mmHg. Exercise thallium 201 myocardial single photon emission computed tomography (\textsuperscript{201}TL SPECT) using a supine bicycle ergometer was performed. The workload was initiated at 25 watts and then increased by 25 watts every 2 minutes. Exercise was completed by 75 watts and a

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image.png}
\caption{Myocardial perfusion imaging with exercise \textsuperscript{201}TL-SPECT. Stress image (left side) revealed an apparent reversible inferoseptal hypoperfusion (arrow) compared with the delayed image (right side).}
\end{figure}
perfusion abnormality was detected in the inferoseptal wall of the left ventricle (Figure 1). Coronary angiography was performed using the Judkins technique. The ostium of the right coronary could not be identified at the expected site. Injection of contrast medium in the sinus of Valsalva revealed that the right coronary artery originated from the left sinus of Valsalva (Figure 2). The left coronary artery was located in the normal position and there was no evidence of atherosclerosis in either the left or right coronary artery. Furthermore, the peripheral distribution of the coronary arteries was normal. However, selective right coronary angiography could not be performed because of technical difficulties. UFT was performed to evaluate the angle of takeoff from the aorta and the
proximal course of the anomalous right coronary artery. The tomographic slice thickness was 3 mm and the scanning period was 100 msec. UFT demonstrated an acute angle takeoff from the aorta of the anomalous right coronary artery. The proximal portion of the right coronary artery traversed between the aorta and pulmonary trunk (Figure 3).

**DISCUSSION**

Anomalous origin of the coronary artery can lead to angina pectoris, acute myocardial infarction or sudden death, even in the absence of atherosclerosis. There are several hypotheses for the pathogenesis of myocardial ischemia or sudden death in patients with anomalous origin of the coronary artery. The oblique takeoff of the anomalous artery produces a slit-like orifice in the aortic wall which can collapse like a valve, particularly during exercise. Furthermore, the presence of the aberrant right coronary artery between the aorta and pulmonary trunk leads to compression by these two great vessels. Previously, coronary angiography was the only method to detect the presence of a coronary anomaly. However, detailed information regarding the proximal portion of the anomalous coronary artery, such as the angle of takeoff and its proximal course, could not be acquired by coronary angiography alone. Recently echocardiography, especially transesophageal echocardiography (TEE), has proven to be a good way to see the course of the proximal course of an anomalous coronary artery. But TEE is a semiinvasive technique accompanied by some discomfort and this patient rejected examination by TEE. In this case UFT offered us more information. The acute angle of takeoff and compression of the anomalous coronary artery by the aorta and pulmonary trunk during exercise may have triggered myocardial ischemia in this patient. Thus, UFT is useful for detection of coronary artery anomalies and noninvasive evaluation of myocardial ischemia in patients with a coronary artery of an anomalous origin. Because his symptoms improved by limitation of exercise and administration of a calcium-channel blocker (diltiazem), the patient did not undergo surgical treatment for this anomaly.

**REFERENCES**